CLAIMS

What is claimed is:

1. A vehicle comprising at least one polyoxymethylene structural support member, wherein the polyoxymethylene structural support member includes a polyoxymethylene component that is a propellent that provides thrust to the vehicle upon pyrolysis or combustion of the polyoxymethylene component or of a product of pyrolysis of the polyoxymethylene component.

2. The vehicle of Claim 1, wherein the vehicle is a satellite or other spacecraft.

3. The vehicle of Claim 1, wherein the polyoxymethylene structural support member includes a noncombustible reinforcement material.

4. The vehicle of Claim 1, further defining an exhaust channel through which the products of pyrolysis and combustion flow, wherein the exhaust channel is in fluid communication with the fuel.

5. The vehicle of Claim 4, further including a nozzle in fluid communication with the exhaust channel.

6. The vehicle of Claim 1, wherein the polyoxymethylene structural support member includes a combustible reinforcement material.

7. The vehicle of Claim 1, wherein the polyoxymethylene structural support member defines at least one oxidant channel through which at least one oxidant flows.

8. The vehicle of Claim 3, wherein the noncombustible material defines at least one oxidant channel through which at least one oxidant can flow.

9. The vehicle of Claim 8, wherein the noncombustible material is an external sleeve that at least partially surrounds the polyoxymethylene component of the polyoxymethylene structure support member.

10. The vehicle of Claim 1, further including an oxidant source in fluid communication with the polyoxymethylene structural support member.

11. The vehicle of Claim 1, wherein the polyoxymethylene structural support member includes at least two structural support segments separated by at least one divider.

12. The vehicle of Claim 1, wherein the polyoxymethylene component includes a solid oxidant.

13. The vehicle of Claim 1, wherein the polyoxymethylene component includes an energetic additive component.

14. The vehicle of Claim 1, wherein the vehicle includes a thruster, wherein the thruster includes a noncombustible shell that at least partially encloses the polyoxymethylene component.

15. The vehicle of Claim 14, further including a combustible support material contacting the structural support member, wherein said combustible support material includes a boron material.

16. The vehicle of Claim 14, wherein the structural support member defines at least one oxidant channel through which at least one oxidant flows.

17. The vehicle of Claim 14, further including a noncombustible material that defines at least one oxidant channel through which at least one oxidant flows.

18. The vehicle of Claim 14, further including an oxidant source in fluid communication with the structural support member.

19. A method of propelling a vehicle, comprising the steps of:

a) employing at least a portion of a solid material, wherein the solid material is a structural member and includes polyoxymethylene, to produce a propulsive gas; and

b) asymmetrically directing at least a portion of the propulsive gas away from the vehicle to provide thrust, thereby propelling the vehicle.

20. The method of Claim 19, wherein employing the solid material includes heating the solid fuel.

21. The method of Claim 20, further including the steps of pyrolyzing the solid fuel to form pyrolysis products.

22. The method of Claim 21, further including the step of combusting the pyrolysis products.

23. The method of Claim 20, wherein the solid fuel is combusted.

24. The method of Claim 19, wherein the oxidant is a solid and is included in the solid fuel.

25. The method of Claim 19, wherein employing the solid fuel to produce a propulsive gas includes employing at least one oxidant.

26. The method of Claim 25, wherein the oxidant is a fluid.

27. The method of Claim 26, wherein the amount of fluid oxidant employed is controlled, thereby controlling the amount of thrust produced.

28. The method of Claim 26, wherein employing the fluid oxidant includes contacting the solid fuel with the fluid oxidant.

29. The method of Claim 25, wherein the oxidant is at least one member selected from the group consisting of hydrogen peroxide, nitrogen tetroxide, oxygen, nitrous oxide, a nitrate, a clorate, and a perchlorate.

30. The method of Claim 29, wherein the perchlorate is potassium perchlorate and the nitrate is hydroxylammonnium nitrate.

31. The method of Claim 19, wherein the solid material includes an energetic additive.

32. The method of Claim 31, wherein the energetic additive includes at least one member selected from the group consisting of 2,4,6-trinitrotoluene, cyclotrimethylenetrinitramine, 1-acetyl-3,5-dinitrocyclotrimethylenetriamine, cyclotetramethylenetetranitramine, 1-acetyl-3,5,7-trinitrocyclotetramethylenetetramine, nitroglycerin, nitroguanidine, and nitrocellulose, and an amide.

33. The method of Claim 19, wherein the material includes at least one additional structural support material.

34. The method of Claim 19, wherein the additional structural support material includes at least one member selected from the group consisting of a metallic facesheet, a metallic mesh, a metallic cloth, carbon fiber, carbon cloth, carbon nanotubes, a ceramic, boron fibers and boron cloth.

35. The method of Claim 19, wherein employing the solid material to produce a propulsive gas includes employing at least one catalyst.

36. The method of Claim 19, wherein employing the solid material to produce a propulsive gas includes continuously heating the solid material with a heat source.

37. The method of Claim 19, wherein employing the solid material to produce a propulsive gas includes contacting hydrogen peroxide with a catalyst to produce a catalysis reaction product and combusting the solid fuel with the catalysis reaction product.

38. The method of Claim 19, wherein employing the solid material to produce a propulsive gas includes heating the solid fuel in the presence of nitrogen tetroxide.

39. The method of Claim 19, wherein employing the solid material to produce a propulsive gas includes combusting the solid fuel with oxygen.

40. The method of Claim 19, wherein employing the solid material to produce a propulsive gas includes heating the solid material in the presence of the oxygen.

41. The method of Claim 19, wherein employing the solid material to produce a propulsive gas includes combusting the solid fuel with potassium perchlorate.

42. The method of Claim 19, wherein employing the solid material to produce a propulsive gas includes combusting the solid fuel with hydroxylammonium nitrate.

43. A material comprising polyoxymethylene and at least one member selected from the group consisting of an oxidant, a structural reinforcement, and an energetic additive.

44. The material of Claim 43, wherein the material defines at least one channel for conducting oxidant or propellant through the material.

45. The material of Claim 43, wherein the oxidant is a solid.

46. The material of Claim 43, wherein the energetic additive includes at least one member selected from the group consisting of 2,4,6-trinitrotoluene, cyclotrimethylenetrinitramine, 1-acetyl-3,5-dinitrocyclotrimethylenetriamine, cyclotetramethylenetetranitramine, 1-acetyl-3,5,7-trinitrocyclotetramethylenetetramine, nitroglycerin, nitroguanidine, and nitrocellulose.

47. The material of Claim 43, wherein the additional structural reinforcement includes at least one member selected from the group consisting of a metallic facesheet, a metallic tube, a metallic mesh, a metallic cloth, carbon fiber, carbon cloth, carbon nanotubes, a ceramic, boron fibers and boron cloth.

48. A process for fabricating structural composites, comprising the steps of:

a) placing a mold material between plates of a mold, wherein the mold material includes polyoxymethylene and at least one material selected from the group consisting of an oxidant, a structural reinforcement, and an energetic additive; and

b) applying pressure to the mold material to at least partially cure the mold material and thereby form a polyoxymethylene rod.

49. The process of Claim 48, further including the step of heating the mold material before pressurizing the mold material.

50. The process of Claim 48, wherein the structural reinforcement is at least one material selected from the group consisting of a metallic facesheet, a metallic tube, a metallic mesh, a metallic cloth, carbon fiber, carbon cloth, carbon nanotubes, a ceramic, boron fibers and boron cloth.

51. The process of Claim 48, further including the step of machining the cured structural composite.

52. The process of Claim 48, further including the steps of:

(a) machining the polyoxymethylene rod to produce radial slots in the polyoxymethylene rod;

(b) inserting additional structural reinforcement material into the radial slots; and

(c) inserting the polyoxymethylene rod into a cylinder.

53. The process of Claim 52, further including the step of cooling the polyoxymethylene rod before it is inserted into the cylinder.

54. The process of Claim 53, further including the step of heating the cylinder prior to inserting the polyoxymethylene rod into the cylinder.

55. The process of Claim 54, further including the step of heating the polyoxymethylene rod and the cylinder after the polyoxymethylene rod has been inserted into the cylinder thereby further curing the polyoxymethylene rod.

56. The process of Claim 52, wherein a bonding agent is employed to bind the polyoxymethylene rod to the cylinder.

57. The process of Claim 48, wherein at least three plates are used to produce more than one structural composite during a single curing process.

58. The process of Claim 57, wherein the plates are lined with structural support material so that at least a portion of the structural composite is defined by the structural support material that lined the plates.

59. A method of producing work, comprising the steps of:

a) heating at least a portion of a material that includes polyoxymethylene to produce a gas; and

b) directing the gas to a means for producing work, thereby producing work.

60. The method of Claim 59, wherein the work is to produce propulsive thrust.

61. The method of Claim 59, wherein the work is employed to produce electrical power.